Introduction

Public Resources Code Sections 25402 requires the California Energy Commission to adopt, implement, and periodically update energy efficiency standards for both residential and nonresidential buildings. Energy Commission staff have developed an estimated energy savings as a result of the implementation of the proposed 2013 Building Energy Efficiency Standards. Energy Commission staff estimated the energy savings from additions and alterations to existing residential buildings as well as the energy savings from newly constructed residential buildings for this endeavor. The estimated energy savings from additions and alterations to existing residential buildings is based on the estimated energy savings from newly constructed residential buildings and a ratio of the expected cost of additions and alterations to existing residential buildings as compared to the cost of newly constructed residential buildings. This paper is limited in scope to the determination of that ratio.

Analysis

The Construction Industry Research Board (CIRB) is a nonprofit research center established in 1974 to provide statistical information on the California building and construction industry. It is funded by grants from construction industry advancement funds, member subscriptions and the sale of reports and data. The most prominent data collected by CIRB is California building permit information, which is collected monthly from more than 525 California cities and counties.

Energy Commission staff used the estimated annual construction data from CIRB which included both newly constructed residential buildings and additions and alterations to existing residential buildings in billions of 2011 present value United States dollars. The last two years of this data were forecasted by CIRB and are shown in italics with the historic data in Table 1 below. Energy Commission staff determined the ratio per year and calculated a 4-point moving average (unit less).

Table 1:
Construct Industry Research Board Annual Construction Estimates
(Billions of 2011 United States dollars)

	Newly Constructed	Additions and Alterations	Total	Ratio	4-Point Average
Year	35.606	5.08	40.686	0.142672583	
2000	35.382	5.295	40.677	0.149652366	
2001	39.826	6.012	45.838	0.150956661	
2002	45.672	6.858	52.53	0.150157646	
2003	49.055	7.442	56.497	0.151707267	0.148359814
2004	48.108	7.876	55.984	0.163714975	0.150618485
2005	35.21	7.278	42.488	0.206702641	0.154134137
2006	23.954	6.643	30.597	0.277323203	0.168070632
2007	13.682	5.323	19.005	0.389051308	0.199862022
2008	8.538	4.121	12.659	0.48266573	0.259198032
2009	9.8	4.444	14.244	0.453469388	0.338935721
2010	9.992	4.352	14.344	0.435548439	0.400627407
2011	*12.672*	*4.608*	*17.28*	*0.363636364*	*0.440183716*
2012	*35.606*	*5.08*	*40.686*	*0.142672583*	*0.43382998*

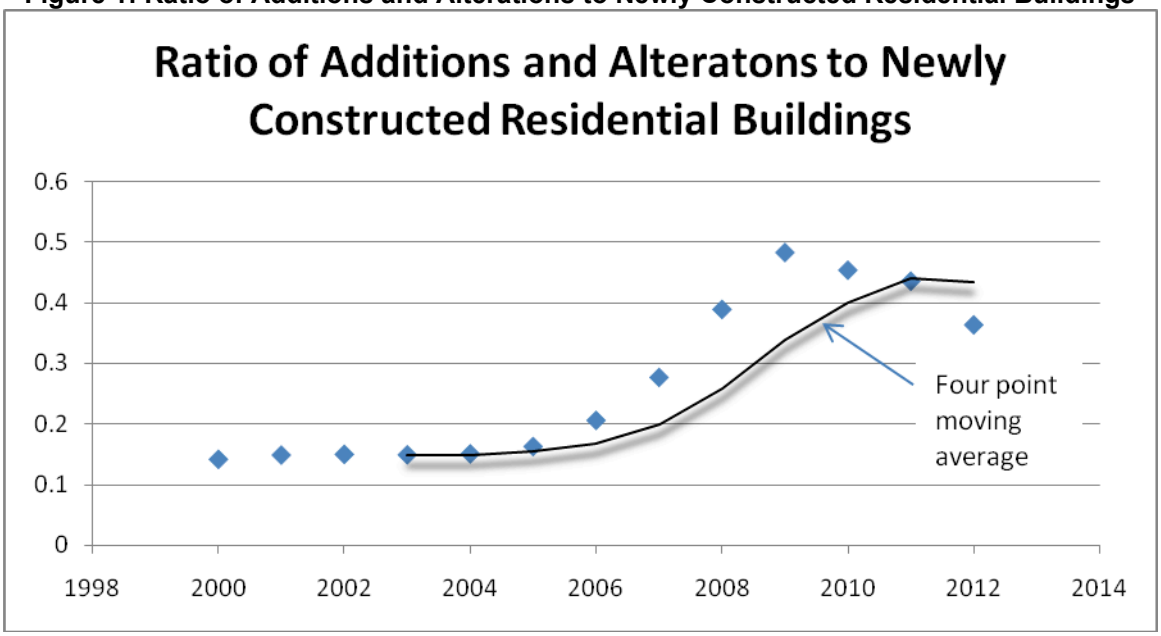
Source:

As Table 1 demonstrates, the ratio peaked in 2008 at 0.4827 when newly constructed building activity was at its lowest and has since trailed off to 0.4355 in 2010. The estimated significant rebound in newly constructed residential buildings shown in the CIRB data may have a significant effect on the ratio as shown (0.1427 in 2012). However, Energy Commission staff is disinclined to rely too heavily on this forecasted data.

Therefore, Energy Commission staff proceeded to use curve-fitting approaches to determine an appropriate fit for the CIRB data. Energy Commission staff had two concerns, first that the ratio used in the 2008 Standards adoption be reasonably represented in the analysis. The ratio used in the 2008 Standards was 0.17 and was derived from similar but slightly different CIRB data. The 4-point moving average shows a result of 0.1681 for 2006 and 0.1999 for 2007, which would be approximately the same results as in the 2008 Standards adoption.

The second concern Energy Commission staff had for the analysis is that it reasonably represents a smooth curve-fit and is not overly reliant on any one annual ratio. Based on the graphical representation shown in Figure 1, Energy Commission staff is reasonably convinced that the 4-point moving average is representative of the annual ratios, without being significantly influenced by any one value.

Figure 1: Ratio of Additions and Alterations to Newly Constructed Residential Buildings



Source:

Conclusion

The ratio of additions and alterations of existing residential buildings to newly constructed residential buildings, based on the available information from the CIRB annual historic and forecast construction data is best represented by 0.43 for use in the 2013 Building Energy Efficiency Standards.